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Preface

This issue contains papers that were originally presented at the Second International Workshop on the Practical Application of Stochastic Modelling (PASM), held at the University of Newcastle in July 2005. The workshop was collocated with Formal Methods 2005.

The aim of PASM is to give a forum for which applies current well-developed formalisms (stochastic Petri nets, stochastic process algebras, layered queueing networks, etc) to real-world case-studies. The papers in the issue cover a broad range of research in the area of applied stochastic modelling and involve both applications and the theory to enable practical application of modelling techniques. These studies are not only of traditional web-service, GRID or computer architectures but also from inter-disciplinary collaborations, such as biological and physical systems. The common link is to see how researchers from diverse fields have overcome the problem of modelling large concurrent and stochastic communicating systems to obtain the particular style of stochastic metric that is important to their field. Successful contributions have demonstrated some novel theoretic advance to model their system or will have been diligent in constructing a detailed and realistic stochastic or probabilistic model and carried the modelling through to the analysis phase. This results in a collection of papers which could be used as outstanding examples of modelling practice in the field of stochastic modelling and exhibit all phases of the modelling lifecycle.

The first paper, by Shaw et al, details some experimentation using stochastic Petri net models of biological systems. In particular the paper addresses the problems of computational cost and parameter estimation, both vital issues in the practical exploitation of current modelling theory. The authors present a new stochastic simulator with mass action kinetics, which is compliant with the Petri net markup language and so should be readily applicable to a wide range of problems. The computational cost is addressed by scheduling multiple simulations across a large cluster of machines. Parameter estimation is studied using a fitting tool and a case study involving the stress response pathway in E.coli, which is a well studied bacterium. A large number of results are presented which show some promise, although some areas of parameter fitting require some refinement for large systems.

A related approach is taken with a very different application by Bradley and

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Gilmore. These authors also employ stochastic simulation to analyse very large models, although the systems of interest here are models of electronic voting which are specified using a stochastic process algebra (SPA). The paper describes a translation from the process algebra to the mass action semantics used by the Dizzy tool, developed for use in biological and chemical rate reactions. The results show an impressive increase in the scale of SPA model it is possible to analyse, as well as some interesting behaviour in the voting system used as a case study.

The paper by Harrison also concerns the use of stochastic process algebra. The aim of this paper is to investigate efficient means for analysing large models by finding the, so-called, reversed process, which then yields separable sub-models. This paper extends Harrisons RCAT theorem which has previously been used to derive product form solutions. In this case the sub-models do not give rise to a product form, but nevertheless still enable exact analysis of the behaviour of parts of the system. Techniques such as this, which address the solvability of large models are of vital practical importance for the use of process algebra and other formulisms in analysing real applications.

Chanin *et al* present an analytical model of the scheduler within the Linux operating system kernel running on non-uniform access (NUMA) machines. The model is presented as a stochastic automata network (SAN) and benchmark data is used to parameterise the model. A large number of results are derived which are compared with simulation. This work is part of a larger study into the scalability of Linux and has led directly to a new version of the Linux load balancing algorithm.

Fourneau and Nott consider the problem of routing within optical packet switched networks. In general these networks employ little, if any, buffering, and the algorithms used are quite different from conventional electronic packet switched networks. The paper concerns the use of convergence routing, which offers bounded transportation time, but generally lower throughput than other mechanisms. The authors present a number of modifications which are shown to improve throughput in simulations. These simulation results also show that the routing algorithms become unstable under bursty traffic conditions. Therefore the use of admission control is also evaluated to reduce burstiness and improve overall performance.

Kubicek analyses an implementation of a scheme to dynamically reallocate machines between pools in a computational grid. This work is based on a stochastic model which computes whether it advantageous for a server to move from serving one class of task to a pool serving a different class of task. In general this movement is not cost free, and this paper looks at what factors influence these costs and therefore the applicability of the analytical results. The approach better enables the grid to meet quality of service targets and hence satisfy customers.

Gilmore and Shkaravska use the stochastic lambda calculus, and the tools DNAmaca and PRISM, to analyse the performance of features of the Camelot functional programming language.

Harder et al present some very novel work on the use of a network telescope to collect, and consequently analyse, network security data. The telescope is in essence an unused sub-network where all traffic directed to it is logged. This creates a

(very large) record of attempts to connect, mostly from viruses and other malicious software. Statistical analysis is used to derive useful results from this data. The scale of the attempted attacks described is perhaps surprising, given that this is unused network address space. This prompts many further interesting research questions surrounding the possibility of using dummy machines, or honey pots, to offer realistic responses to these initial connection attempts.

This is certainly a varied and interesting set of papers, and I am indebted to the authors for their dedication and for choosing to present their work at PASM 2005. I am also indebted to the authors for producing updated and extended versions of their work with only the minimum of prompting from me. I would also like to thank Elsevier and the editor of ENTCS for once again supporting PASM and for providing such excellent resources for producing the manuscripts. Finally I would like to thank all concerned in the organisation of FM 2005, especially Claire Smith at Newcastle, who made the task of organising PASM so much easier.

Nigel Thomas
University of Newcastle upon Tyne, UK